LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

# Sommerfeld Theory Colloquium

**Wednesday, 23rd June 2021**
at 16.15 h

**Prof. Björn Garbrecht**
(TU Munich)

## Limits of strong CP

Quantum mechanical potentials with multiple classically degenerate minima lead to spectra that are determined by the pertaining tunneling amplitudes. For the strong interactions, these classical minima correspond to configurations of a given Chern-Simons number. The tunneling amplitudes are then given by instanton transitions, and the associated gauge invariant eigenstates are the theta-vacua. Under charge-parity (CP) reversal theta changes its sign, and so it is believed that CP-violating observables such as the electric dipole moment of the neutron or the decay of the eta-prime meson into two pions are proportional to theta. Here we argue that this is not the case. This conclusion is based on the assumption that the path integral is dominated by saddle points of finite action and fluctuations around these. In spacetimes of infinite volume, this leads to the requirement of vanishing physical fields at the boundaries. For the gauge fields, this implies topological quantization corresponding to homotopy classes for all integers. We consequently calculate quark correlations by first taking the spacetime volume to infinity and then summing over the sectors. This leads to an absence of CP violation in the quark correlations, in contrast to the conventional way of taking the limits the other way around. While there is an infinite number of homotopy classes in the strong interactions, there is only a finite number of classical vacua for quantum mechanical systems. For the latter the order of taking time to infinity and summing over the transitions is therefore immaterial.

via ZOOM

Ivo Sachs